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Transforming NATO Command and Control for Future Missions

by Charles L. Barry

Overview

No military function is more critical to operational success than effective command and control (C^2). There also is no more daunting military function to get right when it comes to the employment of complex multinational formations in the fast-paced arena of crisis response. Since the Cold War, the North Atlantic Treaty Organization (NATO)—unique as an alliance with a permanent standing C^2 structure—has ventured into a broader spectrum of missions and across a wider geographical area of operations, posing far greater C^2 challenges than the single-mission, fixed-territory defense of the past. Threats to NATO interests have increased, demanding military structures and capabilities that can be employed on shorter notice and further outside NATO territory. At the same time, more sophisticated information-based battle systems and technologies are driving the need for increasingly interoperable forces. A key factor for success in this new environment will be a more agile, flexible, and responsive NATO C^2 architecture for the 21st century.

The NATO summit at Prague in November 2002 was a major milestone in the evolution of alliance command structure and future military force posture. Prague decisions outlined a new arrangement that will take several years and significant investment by both NATO and each member state to put in place. Although many details must still be worked out, early momentum toward the Prague goals is strong and encouraging. Those efforts should not falter at a time of new and proximate threats to NATO member territory and citizens, or collective interests.

Alliance military commanders direct their organizations through the architecture of the distinctive NATO political-military process called consultation, command, and control (C^3). Although C^3 is a single NATO process, consultation is focused on the political process of consensus decisionmaking among allies, while command and control (C^2) is a military function achieved through the full array of NATO military command and force structures, doctrinal command relationships, and technical standards and interoperability agreements. NATO C^2 is also underpinned by a multifaceted communications and information system (CIS) that provides the connectivity and networks to conduct military operations. Related but separate NATO doctrines cover the functions of intelligence, surveillance, and reconnaissance.

The Prague Summit

The Prague NATO summit decisions were major steps in moving NATO toward C^2 capabilities to accomplish the future military tasks of the alliance. NATO leaders agreed that a new military command structure, while still capable of Article 5 collective defense, is to be reorganized and optimized for the more immediate mission of crisis response. A far smaller command structure will be decided upon by June 2003, one that will also be more mobile, flexible, and prepared than the current 1997-era structure. NATO leaders also decided to create by October 2004 a NATO Response Force (NRF) of "technologically advanced, flexible, deployable, interoperable and sustainable force(s) . . . to move quickly to wherever needed, as decided by the Council." In addition, NATO intends to accelerate its investment in common-funded communications and information systems that are essential to an operational, network-centric response force to be ready within 2 years.

What makes Prague more compelling than earlier post-Cold War summits at Washington, Madrid, Brussels, and Rome is that it was preceded by a genuine sense of transatlantic convergence on two points. First, members agreed on the need for a smaller military structure designed around minimum military requirements. Second, the allies foresaw that proximate future threats, such as terrorism, require the availability of a small but potent force capable of engaging in combat operations on short notice at far greater distances than before, perhaps well outside of Europe. Harmony on these points signaled the end of a long migration from exclusive focus on collective defense to full investment in military capabilities to respond to threats well beyond NATO borders—a painstaking and contentious evolution that has taken more than 10 years.

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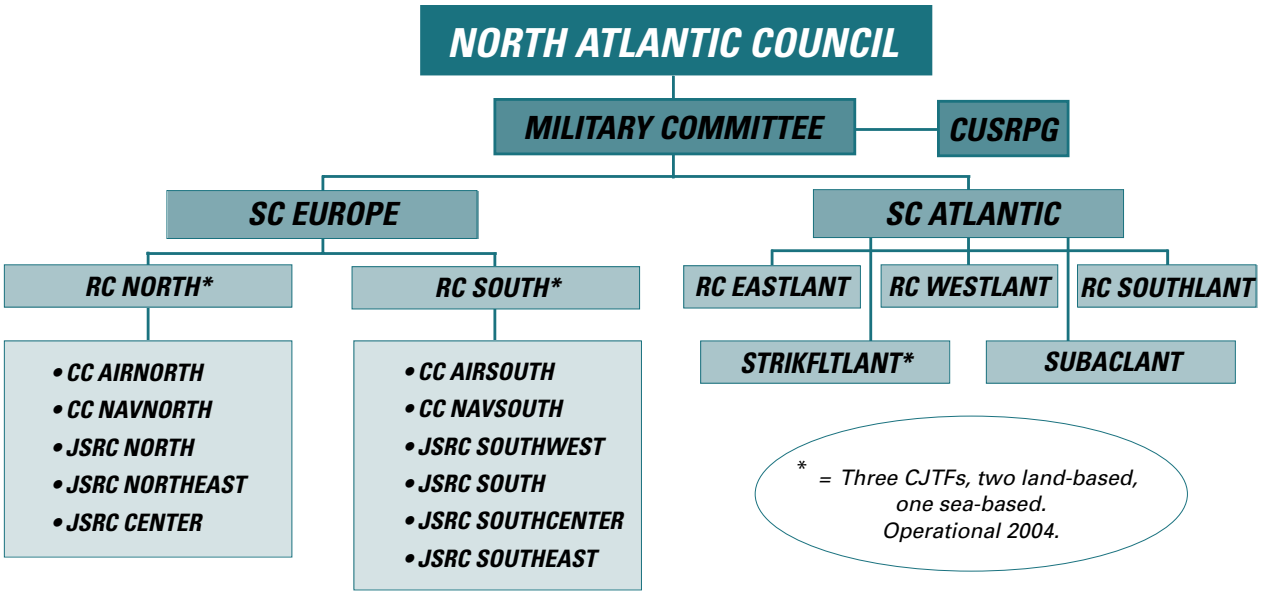
Figure 1. Current NATO Command Structure (1999)



Legend: CUSRPG = Canada-U.S. Regional Planning Group; SC = Strategic Command; RC = Regional Command; CC = Component Command; JHQ = Joint Sub-Regional Headquarters; CJTF = Combined Joint Task Force; STRIKFLTLANT = Striking Fleet Atlantic; SUBACLANT = Submarines Allied Command Atlantic

The Prague summit declaration offered refreshing words of commitment to field specific capabilities and renewed determination to end the long downturn in defense investments. Under an initiative called the Prague Capabilities Commitment (PCC), NATO members signed up for specific capabilities improvements, including more than 100 commitments related to C^2 and information systems. The United States is watching anxiously for hard evidence from each of its allies in the vital areas identified in the PCC. At least at the NATO level, the two common-funded accounts that support C^2—the military headquarters structure and the communications and information systems that support them—should realize higher priority and new resources in the budgets just ahead as a result of the PCC.

The post-Prague NATO challenge is to maintain momentum on the twin goals of producing a new command structure and creating the NRF by the end of 2004—a short period in terms of achieving decisions in a consensus-driven alliance. Past initiatives are testimony to the difficulties of consensus decisionmaking on matters related to military capabilities. The 1997 command structure revision was 5 years in the making and is still not entirely in place even as NATO has chosen to make sweeping additional changes. The 1994 initiative to create Combined Joint Task Forces (CJTF) is finally to be made operational 10 years later. The burden of creating an operational NRF by 2004 falls most directly on old-line European NATO nations rather than on either the United States, which already has forces ready to participate, or on newer NATO members, who will mainly provide niche capabilities and from whom less will be expected initially.

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Command Structure through 2004

The 1990s saw NATO evolve gradually from a one-mission alliance into a European region emergency response agency. Along the way, the alliance reduced its Cold War military structure from a completely fixed-site, 4-tiered, 65-headquarter hierarchy to a more manageable 3-tiered, 20-headquarter structure with demonstrated capabilities to deploy C^2 headquarters and sizable forces to the Balkans to conduct stability operations, crisis response, and even combat operations. By 1999, crisis response just beyond NATO borders had become the primary mission of the integrated military command. In the interim, military ingenuity had to create many ad hoc C^2 solutions to meet crises in Bosnia, Kosovo, and Macedonia. The 1997 command structure also saw a shift in focus from the strategic level of operations to the regional level. In many respects, what NATO achieved in this period both met the needs of new missions and represented a substantial shift in thinking for so ponderous an organization.

However, the array of missions—peacekeeping (by the Stabilization Force in Bosnia), peace enforcement (by the Implementation Force in Bosnia and the Kosovo Force in Kosovo), preventative deployment (Operation *Amber Fox* in Macedonia), embargo

enforcement (Operation *Sharp Guard* in the Adriatic), and actual combat (Operation *Allied Force* over Serbia and Kosovo)—their sudden nature, and the proximity of additional missions even further from NATO territory all threaten to stretch the still-mainly-fixed NATO C^2 apparatus beyond its design limits. Furthermore, the third tier of the current command structure, organized ostensibly to foster jointness and multinationality at seven joint subregional commands (JSRCs), is failing. Some JSRC headquarters are seriously understaffed, as nations give higher priority to deployed headquarters in the Balkans and to high readiness forces at home. Moreover, the JSRCs have little authority over other activities, such as Partnership for Peace requirements. In short, they have few day-to-day missions of real substance. Low funding and sparse training or exercise opportunities reportedly is causing morale to deteriorate. Due to these factors and the press to prepare for future missions, many de facto changes are likely to be in place before the new command structure is due to be operational in 2004.

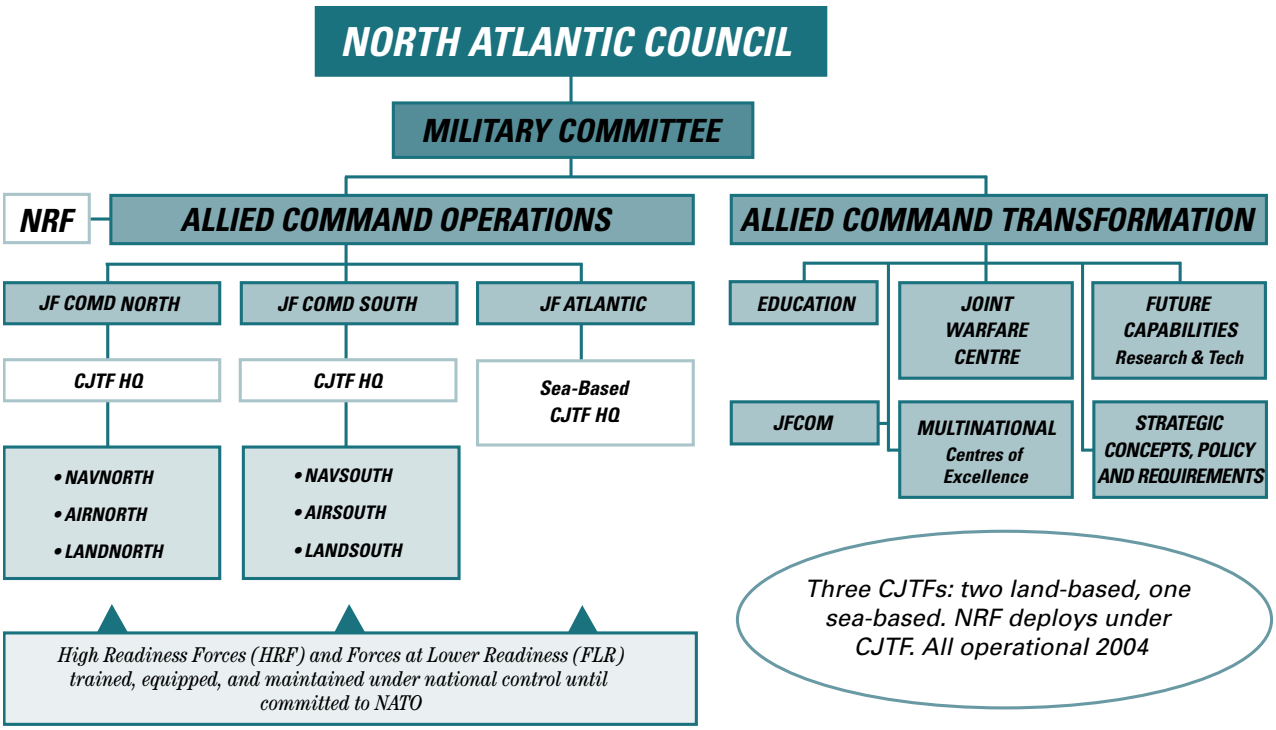
NATO and Transformation

Command structure decisions taken at the Prague summit set a course toward a leaner structure of greater future utility. Two different strategic commands, one operational and one functional, will dominate the structure. A single Allied Command for Operations (ACO) based in Europe will provide C^2 over all NATO operational forces and will lead a far more streamlined command structure. The other strategic command will be the first-ever NATO functional command, a new Allied Command Transformation (ACT), with the mission of transforming NATO military capabilities into a much more interoperable and network-centric force. NATO staffs are to flesh out the rest of the structure by June 2003 following the criteria contained in the Minimum Military Requirement document agreed by defense ministers in September 2002. NATO leaders have not yet officially named the new strategic commands beyond the general references in the Prague Declaration; however, a number of important details about each command have been decided.

Allied Command for Operations

The Prague agreement directed that an allied command for operations would have two subordinate joint force headquarters (JFHQs), each able to generate a land-based CJTF, and a third joint headquarters, able to launch a sea-based CJTF. The two JFHQ commands will be supported by three component (multinational but single service) commands comprised respectively of land, air, and maritime forces. The peacetime mission of the component commands will be both to strengthen interoperability and to train and exercise forces and command elements for commitment under CJTFs and the new NRF. There are also to be fewer combined air operations centers (CAOCs) than the 11 now maintained within the air forces of NATO members.

Figure 2. Future NATO Command Structure



Legend: CUSRPG = Canada-U.S. Regional Planning Group; ALLIED COMMAND OPERATIONS = NATO operational command; ALLIED COMMAND TRANSFORMATION = NATO Transformation Command; NRF = NATO Response Force; CJTF = Combined Joint Task Force. HQs/Forces in white boxes are nonpermanent elements of NATO C^2; JF COMD = Joint Forces Command

The final details of the future military structure are to be approved by defense ministers in June 2003, with implementation, including location decisions and command billet allocations (always a sensitive matter in NATO), likely by the end of 2004. Figure 2 depicts the two future strategic commands. Allied Command Operations is structured with land, air, and maritime component commands under two JFHQs, plus a separate maritime joint force headquarters. Three CJTFs and one NRF indicate the expected organizational locations of the most ready response forces. The future of the longstanding Canada-U.S. Regional Planning Group was not addressed at Prague, so it is shown in its old position, but all elements of the old structure are subject to review as NATO moves toward a leaner force.

The missions for ACO, which will be NATO's only operational strategic command, include collective defense across an expanded NATO territory (the enduring Article 5 mission), Partnership for Peace activities, conducting NATO training and exercises with member and partner forces, Balkan operations in Bosnia and Kosovo, responding to the Prague political commitment to deepen contacts with Mediterranean Dialogue countries, and support of United Nations (UN) operations in Afghanistan. Added to this substantial list of activities will be the Prague mandate to be prepared to respond to crises well beyond NATO territory, mainly by deploying and employing NATO CJTFs and NRFs as directed by the North Atlantic Council. Already, NATO has agreed to support Polish-led forces in Iraq. The large and diverse ACO mission portfolio suggests the need for a highly capable command, one that is fully automated, expertly staffed, and well supported by modern, redundant, and secure communications. The command will need the agility to engage in planning, training, and operating across the full spectrum of NATO engagement, at times simultaneously.

Allied Command Transformation

The strategic command for transformation will be responsible for maintaining momentum in the transformation of NATO forces and for deepening interoperability. Its specific tasks are still being defined. However, based on early staff planning and the similarity of the ACT transformation missions to those of U.S. Joint Forces Command (the commander of which is likely to be dual hated as the commander of ACT at some point in the future), the command will have several important doctrine, force, and concept development roles. It will be setting guidelines, identifying benchmarks, and acting as the executive agent for NATO military authorities on transformation. It will be expected to assist in transformation planning by the militaries of allies and partners. The command will be in North America at the current location of Allied Command Atlantic (ACLANT), but it will also have a prominent presence in Europe to help shape transformation alliance-wide. Much of ACT resources and energies will be directed into experimentation and to working with ACO to achieve readiness objectives, exercise goals, and training standards.

Four other significant missions can be foreseen for ACT. The first is to engage in bringing transformational concepts into the design and execution of partnership activities, especially in the fulfillment of individual membership action plans. A second mission will be to establish a high-fidelity, rapid feedback alliance center for transformation lessons learned to identify concepts useful not only to NATO planners and decisionmakers but to national force and doctrine developers as well. The third area is for Transformation Command to assert influence on funding priorities for NATO testbeds and laboratories, especially at the testbeds and laboratories of the NATO Consultation, Command, and Control Agency (NC3A) where future communications and information technologies are researched. Finally, ACT will oversee the incorporation of transformational doctrine and concepts into official NATO military materials and school curricula, the outcome of which will be the education and training of a new generation of NATO officers for future missions.

ACT may also be asked to provide direct guidance to nations in terms of enhancing interoperability and network-centric capabilities through review of nation contributions to the alliance under the NATO force planning process. As the command most responsible for furthering the effects of interoperability as well as transformation, it would make sense for ACT to comment on the state of progress toward these goals in national as well as NATO-funded programs. Such objective assessments by ACT would help NATO know where to place future emphasis, and it could also help defense ministers to argue more successfully for resources to meet NATO interoperability and transformational guidelines. Along these lines, ACT might eventually produce forward-looking NATO transformation and interoperability planning guidance for use by nations in meeting NATO force goals.

Carving out a substantial, productive ACT role will require solid backing from NATO political leaders. As a first-ever functional command within the alliance, other national and NATO entities already address, in varying degrees, the functions that ACT is expected to gather under its mandate. The most important relationship to work out is between ACT and ACO with regard to transformation, interoperability, and measuring the degree to which NATO capabilities meet those goals. A significant signal will be sent if ACT is assigned a key role in the defense planning process to review national force contributions and to provide a report to NATO political leaders on transformation. Within NATO common-funded procurement, ACT should have a similar influential role in making interoperability evaluations of requirements documents, especially CIS hardware and software.

CJTF and NATO Response Force

The CJTF headquarters concept requires a deployable C^2 capability embedded within the design of nondeployable regional headquarters. When activated, preselected staffs from the parent command, subordinate commands, and sister commands assemble on a permanent nucleus staff and constitute a deployable CJTF headquarters. The CJTF headquarters (HQ) can control a force up to a corps and similarly sized air forces and naval task forces. The forces under a CJTF are drawn from the readiest national forces of NATO members and partners. NATO plans call for a land-based CJTF embedded at each of the two current regional commands of Allied Command Europe (ACE) and a sea-based CJTF under the Striking Fleet Atlantic of ACLANT. The same three CJTFs will be in the new command structure; however, all will be under Allied Command Operations (see figure 2). CJTFs are to become the primary NATO means for future crisis response, yet they are also able to meet Article 5 collective defense requirements. NATO has indicated it may have two

CJTFs deployed concurrently, although the traditional six-month NATO rotation concept would make that a daunting scenario. A variant of the NATO CJTF concept is to provide a CJTF headquarters and support assets to the European Union (EU) for EU-led operations.

Command and control arrangements for the NRF, at this writing, are still being deliberated by NATO. Several options are under consideration: deployment under a permanent NATO command, such as one of the Joint Force HQs; as a separate coalition force under a headquarters provided by a NATO nation; or under a NATO CJTF. Most NRF deployments are expected to be under the last scenario, with a CJTF HQ providing command and control. Since a CJTF HQ is designed to provide C^2 for a force three times the size of an NRF, the NRF can also be characterized as the lead element of a larger follow-on force under a CJTF HQ, thereby affording NATO the ready option to expand operations as necessary. Another advantage of using a CJTF HQ for command and control of the NRF is that its sizable structure includes a Multinational Joint Logistics Center (MJLC), which will be essential to sustain the NRF as well as follow-on forces, since the NRF is likely to deploy with limited supplies.

For the NRF and CJTF concepts to work in tandem, the developing NATO NRF concept will have to harmonize response times and other factors with existing CJTF criteria (or CJTF yardsticks may be modified). The response criterion for a CJTF is 60 days, and mission duration is planned to last up to 2 years. As NATO collaborates on the NRF design, U.S. advocates are proposing a pool of between 21,000 and 28,000 high-readiness forces from which a combined joint task force of variable size can be tailored and deployed within 5 to 30 days, accompanied by 30 days of logistical sustainment. There are numerous ways CJTF and NRF C^2 and other readiness criteria can be harmonized, but more guidance is needed for military planners to draft common deployment plans. One C^2 issue will be whether the existing CJTF design, which is a large headquarters of almost 2,000 personnel (when logisticians, communicators, security, and support elements are included), will need to be modified to incorporate a more austere and agile tactical C^2 element that can deploy quickly with an NRF. Guidance will also be needed with respect to the deployment of two CJTFs. For example, if an NRF deploys, will a second, on-call NRF be stood up along with a second (likely sea-based) CJTF?

A related task in standing up the NRF is to identify both the resources and support elements that a successful NRF employment will require. For example, with only 30 days of sustainment, an NRF would need some support forces to be deployable in a time frame to provide replenishment as on-hand supplies are consumed. In fact, any NRF mission will require an array of support forces—such as embarkation support assets, strategic and tactical transport, long line communications providers, strategic intelligence resources, air defense, combat search and rescue, medical evacuation, and other assets—to be in almost as high a state of readiness as the NRF itself.

Both NRF and CJTF will place new demands on the most ready forces of member nations. The highest readiness forces of nations are few and are also those called upon for stability operations in the Balkans, NATO exercises, Partnership for Peace activities, and (recently) support of UN operations in Afghanistan. These enduring missions and NRF and CJTF will increase competition for scarce forces and resources, at least during periods of NATO exercises and national training.

The vintage 1996 CJTF headquarters concept will require updating as it is melded to the newer NRF concept. Recent exercises indicate that when an embedded CJTF is deployed, it decimates the parent regional headquarter C^2 capability until it can be reconstituted by substantial staff replacements. In addition to the impact the current concept has on its parent headquarter capabilities, the time lag in standing up the CJTF and the reality that the CJTF staff may be able to exercise together only once every 2 years must be considered. When activated, having limited experience in working together will be a significant factor in early staff performance for crisis response. All these factors suggest that a more permanent arrangement may work better in the long run. NATO may find that merging the CJTF concept and the parent JFHQs operational concept into a single standing headquarters along the lines of U.S. combatant commands is the best solution.

An EU Military Role

In December 1999, EU members agreed to have the ability by June 2003 to deploy within 60 days, and sustain for at least 1 year, land forces up to corps size (60,000) plus comparable air and maritime forces. The stated purpose of this force is to give the Union a military capability to respond to international crises by conducting humanitarian, peacekeeping, or peace enforcement operations when the alliance as a whole is not engaged. The forces that EU NATO members have committed to the Union in most cases are dual-tasked for similar NATO operations under the NRF and CJTF. For that reason, the European Union employs NATO standard operating procedures.

The European Union is committed to not duplicate unnecessarily the assets and capabilities that can be made available for its

Table 1: Supported Future Reaction Forces

Reaction Force	Size (up to)	Response Time (days)	Duration	Strategic C^2	Missions	Joint Combined	Initial Operation Ready	Beyond Europe
CJTF	60,000	60	2 years	NATO or EU	humanitarian relief operation (HUMRO), peacekeeping operation (PKO), crisis response	Yes	2004	Possible
NRF	21,000	5–30	30 days +	NATO or coalition	crisis response	Yes	2004	Yes
ERRF	60,000	60	1 year +	EU or NATO	HUMRO, PKO, crisis response	Yes	2003	No (initial)

operations by NATO. That principle is reflected in the EU Rapid Reaction Force (ERRF) C^2 concept, which is based on commands provided by nations and is not an in-place C^2 structure like NATO. During contingency planning, EU members indicate two types of headquarters elements that they would be willing to commit for a particular plan. One is a non-deploying operations headquarters (OPS HQ) that would oversee the operation and provide the political-military interface to the EU Council and Military Staff. The other is the deployable and subordinate Force Headquarters (Force HQ) responsible to the OPS HQ for mission execution. NATO also has offered an OPS HQ capability to the European Union, which would be comprised of the Deputy Allied Commander, Operations (who is always a European) and designated European members of NATO staffs. The NATO arrangement would facilitate the provision of other NATO assets and capabilities, though the OPS HQ would respond to the EU Council rather than NATO authorities. In March 2003, the European Union launched its first operation in Macedonia using a NATO OPS HQ. Many aspects of the NATO–EU arrangement will have to be fine-tuned, not least of which are the circumstances under which C^2 assets will return to NATO.

NATO and the European Union have declared that the ERRF and the NRF are complementary, however the two organizations will have to collaborate on priorities so that conflicts are averted. Most observers expect that NATO CJTF and NRF will respond to missions potentially involving combat operations, and that, at least for the next several years, the EU force will focus on less taxing humanitarian and peacekeeping operations while the Union gets its systems and processes up and running smoothly. That division of labor should deconflict requirements for front line forces (even though the EU Helsinki Force Catalogue includes most of members' best combat equipment), but perhaps not for support forces that provide capabilities common to both missions areas. It must be noted that neither the Helsinki commitment nor the 1992 Petersburg Tasks limit the European Union to missions of any specific size, region, or mission category. However, as one EU official noted, the Union has to learn how to walk first, even if eventually will run too.

Regardless of how missions are assigned, demand will overlap on limited high-value resources such as C^2 elements, communications, transportation, logistics, and funding. Part of the solution may be for the Union to create more of its own support capabilities, such as strategic lift and communications, assets that would also benefit NATO if the allies were to act under the alliance. However, since the European Union has agreed to act only when NATO is not engaged, the immediate issue (by 2004) will be to coordinate both NATO and EU training goals within the time and resource constraints of fewer, smaller exercises.

NATO Force Structure

Although NATO has a permanent command structure it has few standing forces in peacetime. Most permanent personnel are assigned to the command structure already described. The rest are assigned to a few standing naval forces and in-place planning staffs, communications elements, or air defense and air surveillance units. The bulk of NATO forces are committed on a mission-by-mission basis by member nations, usually as preplanned under the NATO biennial force planning process. The forces provided by nations comprise the extension of NATO command and control down through the tactical level, primarily though single-service headquarters commanding organic troops, flights and ships.

An agreed NATO Force Structure document (called MC 317/1) lets nations know what NATO expects from their force contributions in terms of readiness, unit size, deployability, rotation durations, and sustainment, as well as command and control. This guidance helps nations determine the number and readiness requirements for tactical C^2 headquarters for land, air, maritime, and certain specialized forces. Current NATO guidance calls for nations to designate certain deployable land and maritime headquarters as High Readiness Force (HRF) headquarters, and other C^2 elements as Forces of Lower Readiness (FLR). HRF headquarters constitute the NATO crisis response C^2 under the NRF and CJTF concepts. At present NATO has access to only one deployable air headquarters, a Combined Air Operations Center (CAOC) from the United States, however more are planned.

Promulgating NATO standards for C^2 readiness and interoperability is as important for nations as it is for the alliance. Nations use the NATO force structure guidance as input in prioritizing their forces for resource planning. The NATO force structure document establishes criteria for both national and multinational forces.

Table 2: NATO Communications and Information Systems (CIS) Environment

Manager	NATO Command, Control, and Communications Agency (NC3A)
Operator	NATO Communications and Information Systems Operating and Support Agency (NACOSA)
Standards (approved December 2000)	NATO Command, Control, and Communications Technical Architecture (NC3TA)
Major Features	■ includes several major systems upgrades ■ contains COTS-based hardware and software ■ addresses need for mobility ■ integrates networks (for example, LAN and WAN) but still hierarchial and not network technologies
Conclusions	NATO moving on the correct path and needs to stay the course NATO members must invest in NATO standards, procurement of upgradeable technologies, and interoperability

Communications and Information Systems

Military command and control, along with all political and military business of the alliance, is supported by a NATO-wide architecture of communications and information systems (CIS)—better known outside NATO as command, control, communications, and computers (C^4). NATO CIS support for command and control is comprised of systems' hardware and software, as well as the policies and architecture that define how CIS connects and supports NATO land, air, and maritime forces.

CIS connectivity must reach across the whole of NATO territory and wherever forces are deployed (for example, at sea or in the Balkans) and must also tie NATO headquarters in Brussels to all member capitals and link appropriate headquarters of the integrated military structure to national military commands. The system incorporates voice, data, messaging, and video teleconferencing in both secure and clear channel modes. Information and communications traffic is passed via terrestrial lines, surface-based wireless networks, and satellites. NATO CIS has kept pace with the rapid evolution in information age conduits, including use of local area networks (LANs), wide area networks, intranets, and the Internet itself, in addition to digital radio and optical cable means to transmit voice, data, and video information. A significant portion of NATO CIS is deployed on commercial equipment.

CIS is a defense support function overseen since 1996 by the NATO Consultation, Command, and Control Organization (NC3O). That reorganization of the alliance CIS function was undertaken to posture NATO for the growing application of information systems to C^2, in particular for mobile network development. The NC3O develops the technical architecture, standards and protocols, and overall system design from the military tactical level to the political strategic level. The NATO CIS general purpose environment is characterized as having two interoperable domains, a NATO-wide network domain that

Table 3: Major Communications and Information Systems Supporting Military Command and Control

Allied Command Europe (ACE) Automated Command and Control Information Systems (ACCIS)	One of two strategic military C^2 systems. Provides automated C^2 support for commanders throughout ACE using common hardware and software. Services include collaborative software tools, Web services, and Microsoft Office/ Windows 2000. Decision support software allows assessment and exchange of a combined air, land, and maritime NATO-wide operational picture. Baseline fielding is due for completion in 2004.
Maritime Command and Control Information System (MCCIS)	Second strategic C^2 system. Has been operational at more than 60 sites for some time due to a much earlier initiative by ACLANT and the U.S. Space and Warfare Command. COTS-based open architecture system operating over all command levels with proven interoperability. Chosen as the platform for initial NATO Common Operational Picture.
NATO General-Purpose Communications System (NGCS)	Future backbone architecture. Will tie all military C^2 elements together. Deployment began in 2002 in three commercial components, including data, voice, and real-time semipermanent bandwidth on-demand. Communicates via telephone, message, wireless, and satellite links; can be both secure and nonsecure, using military and commercial leased systems.
NATO Integrated Communications System (NCS)—Comprised of four main subsystems	Initial Voice Switched Network (IVSN) is the present telephone network for only about 12,000 subscribers. Will be transitioning to a NATO-wide future system of switched digital networks for voice, data, and video transmissions in the near future as a part of NGCS. NATO Message System (NMS) is replacing the Telegraph Automatic Relay Equipment (TARE) over the next 2 years. State-of-the-art email and secure message system that incorporates a client-server COTS-based military message handling system able to run on either a Windows or Unix. Terrestrial Transmission System is an operational-level network (approximately two-thirds NATO-owned and one-third civil-authority-owned) of tropospheric scatter and microwave links extending from northern Norway through central Europe to eastern Turkey. NATO IV Satellites (IVA [1991] and IVB [1993]) are the latest deployed NATO satellites and make up the satellite communications "leg" of NICS. Each has a 10-year planned life cycle. SATCOM post-2000, the next generation NATO satellite, is scheduled to replace IVA and IVB by 2004 for global wideband video, voice, and data links.
Joint Tactical Information Distribution System (JTID—also called Link 16)	Link 16 is updated late 1970s technology brought to full production in 1997. Currently fielded on NATO airborne warning and control systems and among a few NATO member forces (United States, United Kingdom, France) on tactical aircraft, ships, and land forces. Acts as jam-resistant, spread-spectrum, secure communicatin identification and navigation system for automatic data and voice links among land, air, and maritime forces in real time. Each terminal receives the overall tactical situation automatically in real-time updates. A newer, smaller version of JTIDS, the NATO Multifunctional Information Distribution System (MIDS), was fielded for installation in smaller fighters (such as the F–16). Thousands of additional units are programmed for installation by NATO allies, significant boosting alliance network-centric warfare capabilities. Considered a key future network-centric system.
Crisis Response Operations in NATO Open Systems (CRONOS)	Windows NT Information System initially developed for Implementation Force in Bosnia. Still used with over 1,000 mailboxes and several thousand workstations. Secure connectivity up to NATO Secret between CRONOS and several national and coalition systems
NATO Air Command and Control System (ACCS)	Facilitates planning, tasking, execution, and ssurveillance of all air operations over NATO member territory. Additional ACCS capabilities available to support a CJTF out of area. Based on open system architecture and emphasizes COTS components. First level of operational capability (ACCS LOC1) to be completed by 2005.

links fixed and mobile users into a set of common systems, and a users domain made up of LANs, tactical wireless communications, leased lines, and similar systems. This bi-fold environment provides communications and information connectivity in peacetime, crisis, and conventional war. A separate special purpose segment is reserved for a nuclear operational environment.

Since its establishment, NC3O has pushed CIS toward greater mobility and interoperability, and toward the use of commercial off-the-shelf (COTS) products and systems. It does this through its authority to invest in user-oriented laboratory test bedding and field prototyping, techniques that involve operational users in assessing technologies that might improve NATO operational capabilities. NC3O uses evolutionary acquisition procedures to assess and field new systems and equipment that can be clearly specified, competitively procured, and implemented with low risk. One such program was the sourcing of COTS information technologies to equip NATO peace-support operations in the Balkans rapidly with essential CIS support systems.

NATO CIS serves two broad, overlapping spheres: political consultation and military C^2. At the strategic political-military level, the NATO Integrated Communications System (NICS) is the primary backbone for connectivity from the strategic military commands to NATO headquarters staffs and to alliance member capitals for collective decisionmaking, including nuclear matters. The military side of CIS provides connectivity from the strategic military commands to lower-level commands, down to fixed sites and deployed units (such as CJTFs), providing for alliance-wide operational C^2, albeit still through a hierarchical rather than a peer-to-peer architecture.

Along with political consensus on future missions and a new command structure, NATO has also agreed to a new technical architecture (see section below on setting CIS standards) to provide the standards for CIS that will push investment toward transformational networks and systems. Together, these initiatives fulfill a strategy for complete C^2 redesign. When they are substantially in place, NATO forces will be poised to respond to crises well beyond NATO territory and to perform a wide range of military tasks, from peace operations to combat operations. Attention now shifts to the commitment of national and NATO funds for expeditious fielding of new and upgraded CIS capabilities. Some of the most critical systems and their status are described in table 3.

New missions and technologies have forced new concepts and architectures on the NATO CIS managers at every level. The most central shift is toward what NATO calls "network-enabled capabilities" embedded in far more capable and further dispersed forces. The goal is to link commands and forces in a peer-to-peer network, not just at the top of hierarchical structures. There would be universal access to a common operational picture for all elements—a ship, aircraft, ground unit, or a headquarters at any echelon or component. The added value of networks is substantial, affording alliance commanders faster, more complete battlespace information and force synchronization. That reality lies at the core of the future NATO CIS concept. The potential of network-enabled capabilities has been validated during NATO operations in the Balkans and has set the azimuth for the NATO CIS investments.

For network enabled capabilities to move from the drawing board to operational use in complex joint *and* combined scenarios, NATO must meld complex technological standards, alliance CIS doctrine, and operational employment concepts. More than seven years of research, experimentation and ad hoc operational solutions have to coalesce into flexible, open-ended operational concepts that identity specific investment goals. The new NATO C^3 Technical Architecture also must be put into place. The next major step is for NATO members and partners to prioritize with some urgency the operational CIS needs of the alliance. Then the hardest part will come, committing steady, substantial investments to CIS; enough resources to field "reach down, reach across" network connectivity that truly operationalize recent agreements and standards. Only more investment can push expansion of the network. Finally, as a system materializes, vigorous attention to lessons learned will identity the gaps and limits of network centric command and control, and effective new capabilities will emerge. Already, experience shows NATO will have to grapple with some of the risks of networking, such as information overload and the tendencies toward centralization of decisionmaking and loss of individual initiative at the tactical level.

C^2 Relationships and Procedures

A comprehensive analysis of military command and control must include a discussion of command relationships. NATO has a well-established menu of carefully defined command relationships (see table 4) that provides both military and political flexibility and triggers clear lines of responsibility between commands as well as between the alliance and its member forces. NATO used unique command relationships to overcome early Russian sensitivities to providing its national forces for peace operations under NATO in the Balkans. Command relationships identify the specific authorities that higher commanders are given over subordinate units, such as

Table 4: NATO Commander Relationships: Cold War to Present

Operational Command	Assigns missions, deploys units, reassigns forces, and retains or delegates operational or tactical control
Operational Control	Directs forces to accomplish specific, limited missions (including deployment) and delegates tactical control of units but not of their components
Tactical Command	Assigns tasks to forces under command to accomplish missions assigned by higher authority
Tactical Control	Controls local movement or maneuver of subunits to accomplish specific missions assigned by higher authority
Coordinating Authority	Coordinates actions of units of two or more countries, services, or forces. Can require consultations but cannot compel agreement

whether they are responsible for positioning subordinate forces and whether they are authorized to subdivide assigned units.

The sometimes confusing domain of longstanding NATO C^2 relationships, responsibilities, and procedures is usually given too little attention in designing future networked C^2 systems and flexible structures. After all, the agreed command relationships will determine how new command structures and communication systems will be employed in future missions. Command relationships compose the essential fine print that allowed General Michael Jackson, British commander of forces in Kosovo, to refuse the order of General Wesley Clark, NATO Supreme Allied Commander, Europe, to deploy to Pristina airport ahead of advancing Russian forces in 1999.

The present NATO menu of command relationships dates back to the early 1980s, and the definitions may be more suited for lawyers than commanders in battle (see table 4). Moreover, they were agreed principally to protect national prerogatives over how and for what purposes forces handed over to NATO would be employed in strict pursuit of a narrow alliance purpose—for example, collective defense of allied territory.

What is clear from these definitions is that they were suited for a formal, vertical command structure engaged in the single, well-defined mission. However, NATO may be outgrowing these stiff arrangements as the allies employ multinational formations in Bosnia well below the division level. Lingering emphasis on national prerogatives, many of which nations are ill equipped to execute—such as logistics support—creates a situation in which field commanders act more as coordinators than commanders. The more NATO adopts network-warfare concepts and rapid response roles, the less appropriate the current menu of command arrangements becomes.

Another concern arises out of more diverse NATO missions and command arrangements. Rapid response impacts the timing of force turnover from national to NATO control, as well as from one command to another. When a commander actually takes command determines whether he is really directing or only coordinating such essential pre-mission functions as operational training, deployment readiness, and logistics planning. Sensitive command relationships and national versus multinational responsibilities are genuine issues, yet, without streamlining, they will encumber rapid action and could endanger both mission and forces. The need to address outdated modalities and to agree to arrangements more suited for new NATO missions of time-critical deployments and crisis response has already been demonstrated. In essence, the allies need to push down controls and accept more decentralized operational and tactical decisionmaking.

Interoperability

Interoperability goals are as old as the alliance, but they have never been more important or more arduously pursued. As national forces transform and improve their readiness, it will be even more essential that NATO standards related to interoperability of command networks and communications systems become a priority design specification for every affected national system. In the past, NATO interoperability features included in U.S. and allied equipment designs were easy prey when faced with trimming systems to meet budget constraints. In a future networked force, interoperability of forces and headquarters at every echelon becomes even more critical. American systems now include interoperability as a key performance parameter; however, interoperability is defined as *within U.S. forces*, not NATO interoperability. The United States and its allies have more work to do before national and NATO standards are sufficiently harmonized.

Command and control is the most crucial medium for interoperability. As NATO shifts toward network-centric operations, demanding closer cooperation among more dispersed forces, the importance of interoperable C^2 grows exponentially. Forces that expect to operate together must at least be able to communicate with each other via both voice and data formats, even though they are not yet equipped with other systems that are at or close to the leading edge of technology. NATO has a new command structure, standards, and equipment in the pipeline for its international headquarters that will satisfy these requirements. What hampers NATO is the lack of national investment of member states in the costly proposition of conversion to NATO architectures and standardized equipment. European NATO members are reluctant to invest in national systems that are NATO compatible in addition to being compatible with non-NATO national systems. Every additional interface represents increased cost. The United States is also guilty of assigning NATO interoperability a lower priority in equipment design and technology transfer decisions. As a result, present NATO interoperability languishes at a modest level of manual connectivity and mainly procedural interfaces. In the NATO hierarchy of interoperable force capabilities, this means most of NATO interoperates at Levels 1 or 2 (see figure 3).

The NATO military structure has always sought (and in some measure achieved) interoperability by linking C^2 structures at the top. It is now pursuing the means to work more closely and effectively together down through organizations, where sensors and shooters, logisticians and intelligence specialists, operate together. The future promises still greater demand for interoperable networked command and control. In addition to the great complexity of incompatible national C^2 systems already in place and the significant cost associated with adopting NATO standards, interfacing, and direct links, the chief obstacle is also that nations have not given sufficient priority to proliferating NATO-compatible gear across national systems and nodes that increasingly need secure, high-speed, broadband voice/data communications with allied counterpart systems and nodes as well as with NATO.

Fortunately, the goal of networking allied military forces fits into the natural, continuous modernization of both NATO and national C^2 systems. Equipment is becoming obsolete at a faster pace, and the programming of replacements is almost continuous for many defense budgets. Through targeted and protected investment, backed by both political and military determination, much of NATO can move from Level 2 to Level 3 interoperability and genuine networking, at least through interface protocols.

The NATO interoperability vision should be a robust, flexible structure sharing high volumes of information almost instantaneously among many nodes that are more technologically sophisticated, and doing so effectively even under the stress of long-range, short-notice operations characterized by rapidly changing command and force geometries. The rigid C^2 hierarchy of years past must transform to be

Figure 3. Communications and Information Systems Interoperability Snapshot

Interoperability is the ability of alliance forces and, when appropriate, forces of partners and other nations to train, exercise, and operate effectively together in the execution of assigned missions and tasks.

The four levels of CIS interoperability are

Level 4:
seamless sharing of information—integrated data transfer applications

Level 3:
seamless sharing of data—common data exchange model

Level 2:
structured data exchange—manual and automated read

Level 1:
unstructured data exchange—manual read only

Most NATO CIS elements interoperate at Level 1 or 2 (for example, secure email, and automated secure message traffic).

Level 4 requires full access across national systems—unlikely due to member prerogatives to maintain some information behind national firewalls.

The realistic goal should be Level 3—national systems with common data exchange architectures or surrogate interface applications can share appropriate data but are not intrusive.

characterized by greater flexibility and more direct, lateral connectivity. The core function of command and control—the art and science of conducting military operations over joint, multinational forces—will remain fundamentally the same, executed through a familiar hierarchical structure. However, the information flows for C^2 will become a networked system that requires new C^2 doctrine—new ways to take advantage of opportunities for action. The information structures required for success under the new doctrine will bear little resemblance to those of the past. To realize the potential of these information-based concepts, it will be essential that interoperable connectivity be much faster and more reliable than in the past.

Setting CIS Standards: NC3TA

In December 2000, the alliance approved the NATO Command, Control, and Communications Technical Architecture (NC3TA). The new technical architecture is an open system, COTS-focused design aimed at achieving near-term interoperability requirements. For example, NC3O worked with manufacturers to promulgate NATO Standardization Agreement (STANAG) 4591 on Narrow Band Voice Coders (i.e., commercial cellular telephones that incorporate NATO-standard encryption technology). Providing industry with information such as STANAG 4591 speeds CIS interoperability by defining a user market and encouraging manufacturers to provide the latest technology at competitive prices.

Technical standards play a crucial if inconspicuous role as systems are modernized or transformed. Without adherence to standards, ever more complex arrays of information systems will mean more is worse rather than better. NATO has more than 1,700 standards in nearly 1,000 agreements across all domains and has close to 300 more under development, many addressing information architectures. NC3TA identifies the services, building blocks, interfaces, standards, profiles, and related products, and it provides the technical guidelines for implementation of NATO C^3 systems. These represent the minimum rules governing the specification, interaction, and interdependence of the parts of the NATO C^3 system, the purpose of which is to create interoperability.

The new NATO architecture focuses on supporting standardization of information services at the boundaries between NATO Common Funded (NCF) systems and national systems. These service boundary standards can be used with partners and by members for nation-to-nation interoperability, as well as among and with NCF systems. One example cited is that NATO might specify the use of the joint photographic experts group file format to transmit graphics between systems, but nations may use other formats (such as bitmap) as an internal preference.

In November 2001, NATO published its plan for selection of technical services and standards that must be available at the boundaries (interface) between systems. For example, NATO mandates that Web services be exchangeable using hypertext transfer protocol, but it does not tell nations or staffs that they must use the Windows 2000 operating system. By elaborating on a minimum set of boundary services, NATO reduces the expense (and often eliminates

time-consuming debates) of meeting NATO standards within a system focused on interface standards and not complete system standardization. The boundary architecture is based on the concept of a federation of fixed and mobile systems and networks that together comprise a NATO intranet. The system has the Internet standards and Internet protocols at its core, including the four-layer Transmission Control Protocol/Internet Protocol stack that many commercial applications (for example, e-mail) use. As the use of Internet standards and accepted protocol stacks testifies, NATO is committed to the adoption of commercial standards wherever possible. Although off-the-shelf may be militarized by virtue of fitting it in reinforced housing or adding military-specific accessories, COTS equipment itself remains unmodified as much as possible when incorporated into the NATO CIS inventory.

The NATO consensus decisionmaking processes can be too tedious for reaching timely agreements on CIS standards, particularly for information systems. Dramatically shortened life cycles for new products have become the rule, not the exception. Some standards arrive well after NC3O is near acceptance of the next system. To deal with this reality, NATO seeks military-specific CIS standards only when a significant benefit can be derived and where a desired level of interoperability can be achieved. NATO looks for evidence of a near-term standardization benefit and sufficient scale of application. Wherever possible, existing systems standards or open standards (that is, COTS standards) are the default.

However, standards remain difficult to put in place, and, even when agreed, interoperability often proves elusive. Standards can be ignored or adoption delayed due to prohibitive cost of transition. Therefore, the NATO goal of developing, implementing, and sustaining a fully interoperable information system will demand priority resources by both NATO and national budgets. Agencies such as NC3O have to keep working for better solutions. Software programmable radios, as one example of a potential technical solution, are exciting but still expensive and untested. However, such systems offer hope and point the way to ultimate success in the goal of interoperable NATO forces and transformational command and control in the future.

Conclusion

NATO has been adapting its C^2 structures, CIS, and related policies steadily since the end of the Cold War and can take satisfaction in agreements on a leaner command structure, more ready forces, selective investment in state-of-the-art communications and information systems, and new standards that make genuine interoperability more likely in the future. However, decisions at and since the Prague summit signal that it is now time to bring the new networked C^2 concept on line. That means more funding and tough choices. Nations will have to realign investment priorities away from large, relatively unneeded force postures and toward a transformed command and control capability that can be employed soon in places like Afghanistan. This is a challenge at the national level, where investment and convergence on new concepts for command and control—including network-centric operations—still require far more emphasis from military commanders, civilian leaders, and legislatures. Funding should be re-prioritized toward networked interoperable C^2, and to the extent shortfalls still exist, additional funding should be allocated at the first budgeting opportunity. It will soon be true that if you cannot network your national C^2 at every level with other allies and the alliance, you will not be able to participate in NATO's military structure, even for Article 5 missions.

Though fully networked C^2 is the linchpin for future alliance operations, NATO will not be able to transform all of its C^2 structure at once. Even with off-the-shelf technologies and increased national funding, it will take time and money before an alliance-wide transformational, network-centric C^2 can be achieved and sustained. The immediate priority should be to establish these capabilities in the NATO Response Force and in appropriate CJTF HQs responsible for NRF employment. As NATO's chief operator, Allied Command Operations commanded by U.S. Marine General James Jones has already identified the NRF as 'Priority One' for C^2 investment. The next step will be organizing, equipping, and training the NRF and external commands essential to its deployment and employment. That will require NATO's other strategic command—ACT, under British Admiral Ian Forbes, and soon to be led by U.S. Admiral Edmund Giambastiani, the commander already responsible for all U.S. transformation at Joint Forces Command—to collaborate with ACO on a rigorous exercise and training program that will transform alliance doctrine and concepts along with new structures and hardware. At least for the near term, the NRF will be the focal point of NATO C^2 transformation for both strategic commands.

Moreover, C^2 transformation cannot be delayed. Allied Command Operations' C^2 capabilities will be tested beyond any previous deployment when NATO assumes full responsibility for the International Security Assistance Force in Kabul, Afghanistan, in August 2003. NATO learned during its years of political struggle over CJTF that not having one did not mean not needing to deploy one on short notice in the Balkans. Both strategic commands must know that deploying an NRF, to Afghanistan or some other area of collective interest, is a distinct near-term possibility. NATO members must be equally seized with this prospect as they go about fulfilling their specific Prague Capabilities Commitments that will transform command and control for future missions.

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